REMARKS

Status of Claims

No claims have been cancelled.

Claims 1-10 remain pending in the present application.

Independent Claim 1 has been amended, by the foregoing amendments, to more clearly recite that the present invention is a method for "minimizing formation of nitrogen oxides in an incineration apparatus". It is believed that these amendments are supported by the as-filed specification and that no new matter has been introduced thereby (see published version of present application, US 2004/0143149, hereinafter "US'149", paragraphs [0001], [0008], [0020] and [0022], among others).

The Present Invention

Generally, the present invention relates to a method for minimizing formation of nitrogen oxides in an incineration apparatus. While the present invention does reduce the emission of gaseous products, such as nitrogen oxides, into the atmosphere, the present invention achieves this by the novel and unobvious method of minimizing formation of nitrogen oxides in incineration apparatus, thereby reducing the need for post-formation treatment methods. While it is known to incinerate or combust a stream comprising waste products of a chemical reaction process to reduce the amount of such waste products emitted into the atmosphere, the present invention achieves reduction in the emission of nitrogen oxides, with a commensurate reduction in the supplemental fuel required for the incineration/combustion, by minimizing formation of nitrogen oxide species in the incineration/combustion step. In particular, this is achieved by the step of preheating the waste product stream prior to feeding it to the incinerator/combustion apparatus. Moreover, overall process efficiency may be increased by application of the present invention in an embodiment wherein the heat used to preheat the waste products is derived from cooling the raw product stream. (See paragraphs [0005], [0007], [0009] and [0022]-[0023] of the present specification, published as US 2004/0143149, hereinafter "US'149").

As discussed in the present specification (see paragraphs [0007]-[0008] of US'149), the formation of "thermal NOx" occurs when nitrogen present in atmospheric air is subjected to high temperatures, such as in conventional combustion and incineration apparatus. Thermal NOx is usually a combination of nitric oxide and nitrogen dioxide and is indistinguishable from other forms of NOx once released to the environment. While it is, of course, possible and well-known to treat and destroy NOx, after it is formed and before it is released into the atmosphere, by various methods including, but not limited to, catalytic treatment of effluent containing the NOx (which is disclosed in Schofield; see also paragraph [0008] of US'149), it is advantageous to first reduce the amount of NOx to be destroyed by minimizing its formation to begin with. This is what the present invention achieves by preheating the waste product stream prior to feeding it to the incinerator/combustion apparatus.

More particularly, the present invention, as recited in amended independent Claims1, comprises the steps of: (a) producing a reaction product comprising a hot mixed gas stream, (b) producing a cooled mixed gas stream by directing the hot mixed gas stream through a heat exchanger system, (c) separating the cooled mixed gas stream into a cooled product stream and a cooled waste stream, (d) producing a preheated waste stream by directing the cooled waste stream through a heat exchanger system, and (e) incinerating the preheated waste stream by directing it into an incinerator.

Furthermore, in a particular embodiment of the present invention, as recited in dependent Claims 6 and 7, one or more of the heat exchangers may comprise a shell and tube exchanger which is configured, and may have disk-shaped and donut-shaped baffles in the shell portion of the exchanger, to ensure that the constituents of the hot mixed gas are maintained above their melting points. However, these features are not critical to the present invention as recited in amended independent Claim 1, discussed hereinabove, but rather, merely represent more specific advantageous embodiments.

Objection to Drawings

The drawings have been objected to under 37 C.F.R. § 1.83(a) and the Examiner has required that the drawings must be amended to show the features of Claims 6 and 7. The requirements relating to drawings are set forth in 37 C.F.R. § 1.83(a), as follows:

> (a) The drawing in a nonprovisional application must show every feature of the invention specified in the claims. However, conventional features disclosed in the description and claims, where their detailed illustration is not essential for a proper understanding of the invention, should be illustrated in the drawing in the form of a graphical drawing symbol or a labeled representation (e.g., a labeled rectangular box).
> (emphasis added)

As evidenced in part by the Examiner's own citation of Eagle et al., the features recited in Claims 6 and 7 (i.e., shell and tube heat exchanger with a series of disk-shaped and donut-shaped baffles, etc.) are conventional, well-known features. Shell and tube type heat exchangers are well-known. It is also conventional and well-known among persons of ordinary skill for such heat exchangers to have a series of disk-shaped and donut-shaped baffles configured such that the flow of the hot mixed gas will alternate back and forth across the tubes of the heat exchanger.

Applicants and their attorney believe that a detailed illustration of these features, recited in dependent Claims 6 and 7, is not essential for a proper understanding of the present invention, the critical features of which are recited in amended independent Claim 1. Rather, the subject matter of dependent Claims 6 and 7 represent only one embodiment of the present invention. Thus, it is believed that the current representation of the heat exchanger in the existing drawings as a rectangular box labeled 200 and referred to in the present specification as the "heat exchanger section" is sufficient to meet the requirements of 37 C.F.R. § 1.83(a) without modification or amendment.

In the foregoing circumstances, withdrawal of the objection to the drawings is hereby respectfully requested.

Claim Rejections Under 35 U.S.C. §§ 102 and 103

On pages 3-4 of the Office Action, Claims 1, 2, 4, 5, and 8-10 have been rejected, under 35 U.S.C. § 102(b), as being anticipated by Schofield (US3,977,832). The Examiner asserts that Schofield discloses all the features of Claims 1, 2, 4, 5, and 8-10 in the description of existing nitric acid technology. Additionally, on pages 4-7 of the Office Action, Claims 1-5 and 8-10 have been rejected, under 35 U.S.C. § 103(a), as being obvious and, therefore, unpatentable over Applicants' own disclosure in view of Schofield. The examiner believes that while the features of (1) producing a cooled mixed gas stream by directing the hot mixed gas stream through a heat exchanger system to form a preheated waste gas stream, (2) using preheated supplemental fuel to incinerate the waste gas stream, and (3) using preheated oxygen-containing stream to incinerate the waste gas stream, are not expressly disclosed in Schofield, these features would be obvious modifications or enhancements to the prior art process. Applicants respectfully traverse these rejections for the reasons which follow.

Schofield fails to anticipate or make obvious the present invention, as recited in amended independent Claim 1, because Schofield fails to disclose or suggest a method for minimizing formation of nitrogen oxides in an incineration apparatus. Rather, Schofield discusses a typical method for treating nitrogen oxides once they have already been formed in a nitric acid production process. Schofield also entirely fails to disclose, or suggest, the step of incinerating a preheated waste stream by directing it into an incinerator, as recited in amended independent Claim 1. Rather, Schofield discloses a novel system for controlling the rate of flow of process air in a nitric acid production plant, which also happens to involve the step of catalytic combustion of a gaseous stream which already comprises nitrogen oxides.

More particularly, Schofield describes the use of a heat exchanger to pre-heat a gaseous stream which already contains nitrogen oxides. There is no discussion or suggestion of any way to minimize formation of the nitrogen oxides so that the gaseous stream comprises less NOx to be post-treated, before release to the atmosphere. Schofield further describes the subsequent "catalytic combustion" of the heated gaseous stream in a "NOx abatement unit" which is not oxidative, pyrolytic incineration

as in the present invention, but rather, it is chemical "reduction" in the presence of a catalyst. Schofield states that "the gas is treated with a suitable reductant, such as natural gas or other hydrocarbon fuel" in the presence of "noble metal or other suitable catalyst promoting the desired reduction of NOx", whereby the NOx is reduced to elemental nitrogen (see Schofield, Col. 1, lines 43-45, and Col. 4, lines 30-32). This catalytic combustion described in Schofield is different from, and is not analogous to, the incineration step of the method of the present invention. Paragraph [0039] of the present specification, US'149, explains that the incinerator destroys the waste materials (VOCs) in the waste stream by pyrolysis, which is an oxidative reaction not requiring a catalyst, whereas the catalytic combustion of Schofield is reductive and requires a catalyst. They are very different.

Persons of ordinary skill in the art will immediately recognize that the incinerator step of the present invention recited in Claim 1, and the catalytic combustion step of Schofield, are not analogous or interchangeable. In fact, they could be advantageously used together in succession to achieve a further overall reduction in NOx emissions. For example, the catalytic combustion step of Schofield could be added as a post-treatment step to the method of the present invention recited in Claim 1, i.e., subsequent to the incineration step of the present invention, to convert any nitrogen oxides that are formed in the incineration step, since the preheating step of the present invention minimizes, but may not entirely prevent, formation of nitrogen oxides in the incineration step. It is noted that substituting the catalytic combustion step of Schofield for the incineration step of the present invention would not achieve minimization of formation of nitrogen oxides, even with preheating the gas stream fed to this step, because the nitrogen oxides are not formed in such a catalytic combustion step. They are different, non-substitutable, process steps.

Thus, Schofield teaches the preheating and treatment of a gas stream which already contains nitrogen oxides and, in no way, discloses or suggests a method to minimize formation of the nitrogen oxides. Furthermore, the catalytic combustion step of Schofield is different from the incineration step of the present invention – these steps are not interchangeable.

Lastly, Claims 6 and 7 have been rejected, under 35 U.S.C. § 103(a), as being obvious in view of Schofield and further in view of Eagle et al. (US4,230,669) on pages 7-8 of the Office Action. The Examiner asserts that it would have been obvious (1) to use a shell and tube heat exchanger to transfer heat from one process stream to another, and (2) that it would be necessary to maintain the heated process stream's temperature above the constituent's melting point to prevent accumulation of solids, and (3) to select and design a heat exchanger capable of such temperature maintenance, including the use of disk-shaped and donut-shaped baffles within the shell portion of the heat exchanger.

As discussed hereinabove, it is believed that the present invention, as recited in amended independent Claim 1, is novel and unobvious over Schofield because Schofield fails to disclose or suggest either a method for minimizing formation of nitrogen oxides in an incinerator apparatus or a method involving an incineration step. The Examiner has cited Eagle et al. for its disclosure of heat exchanger configurations and features. These disclosures, however, fail to remedy the aforesaid deficiencies of Schofield. Eagle et al. in no way discloses or suggests either a method for minimizing formation of nitrogen oxides in an incinerator apparatus or a process involving an incineration step. Since Claims 6 and 7 each depend, directly or indirectly, from amended independent Claim 1, it is believed that they are novel and unobvious over both Schofield and Eagle et al., whether taken alone or in combination.

In the foregoing circumstances, withdrawal of this rejection of Claims 6 and 7 is hereby respectfully requested.

Based on the foregoing explanation, it is believed that the present invention, as recited in amended independent Claim 1, is novel and unobvious over Schofield, as well as the combination of Schofield and Eagle et al. Since each of Claims 2-10 depend, directly or indirectly, from amended independent Claim 1, it is also believed that the each of dependent Claims 2-10 is also patentable and allowable over Schofield, as well as the combination of Schofield and Eagle et al.

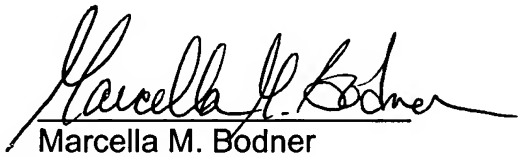
CONCLUSION

Based upon the foregoing Remarks and explanation, Applicant and his attorney hereby respectfully request re-examination and allowance of Claims 1-10.

An extension fee of $450 is believed to be due in connection with submission of this Amendment within two (2) month after the due date set by the Office Action. The $450 extension fee is addressed by the Petition For Extension Of Time which accompanies this Amendment.

If any additional fees are due, including extension and petition fees, in connection with the submission of this Amendment, the Examiner is hereby authorized to charge them, as well to credit any overpayments, to **Deposit Account No. 18-1850**.

Respectfully submitted,



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